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ILLUMINATING ENGINEERING—A NEW PROFESSION.

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Since the time of the cave dwellers men have found artificial illumination a convenience if not a necessity; but only within the present century has the design of illumination system been considered for such importance as to become a special branch of engineering. In fact the first American college course bearing the name illumination was planned and taught by the writer in 1901. This was given at the University of Colorado and occupied two periods a week for a semester. The profession is so new that it is not mentioned in even the most recent dictionaries; so it is thought that it will be of interest to the members of the Iowa Academy of Science to learn of the problems of the illuminating engineer and the materials with which he works.

Roughly the problems may be divided into those of interior and exterior illumination; the variety and number of the former being far greater than the latter. It would seem to be a simple thing to light a lecture hall, for example, so that it would be satisfactory for the purpose desired; but such is not the case, as the illumination of audience rooms is among the most difficult problems presented for solution. The requirements of such a place are that the speaker's face shall be so illuminated that the persons in the audience can see his expressions distinctly; next the audience shall be so illuminated that the speaker can see the effect of his words and so get the proper reaction; and finally the intensity and color of the illumination shall be such the the audience is in the proper frame of mind. It is thus seen that before the problem can be stated physically, in terms of illumination, it must be solved as a problem of psycho-physiology, from the primary data of the effect of light on speaker and audience. As an illustration of the above statement the writer would call your attention to the instances where you have attended church in the evening and been made drowsy; supposedly by the dull sermon when as a matter of fact it was by the bright choir lights which were within the range of your vision.

Having determined the intensity of illumination required; the next problem is to select the illuminant which will give most nearly the desired effect. As the effect is determined as much by color as by intensity and color can be modified by the use of colored globes, the choice of an illuminant for a given case is determined largely by availability and convenience. Owing to the almost universal use of electric power and the great variety and convenience of electric lamps they are usually given the preference, though they are surpassed in cheapness by gas and oil lamps. The intensity of illumination produced by a given set of light sources may be calculated exactly; so this part of the problem is comparatively simple, except as architectural features may interfere with the desired location of the lamps.

This brings up the third part of the problem; the relation of illumination and lamp supports to architecture. A room may be made or marred, artistically, by either the lamp supports or the illumination. No doubt each of you can recall an instance of a room which was harmonious as to every decoration but which was equiped with lamp fixtures which did not match the decorations and so spoiled an otherwise pleasing effect; or a room which was well proportioned by daylight but which looked all out of proportion by artificial light, due to the effect of the change in the position of the shadows. The lamps and their supports should be such that the occupants of a room are not conscious of them except as part of the general scheme of decoration.

Fourth and last the installation must be economical in first cost and operation. This does not necessarily mean that it must be cheap, for in many cases cheapness is not economy but waste; as in the case of a poorly lighted shop where the decreased efficiency of the workmen, due to the poor light, involves a greater expense, per unit of product, than an adequate lighting system.

The materials with which the illuminating engineer deals, lamps of various kinds, have been studied longer than either the psycho-physiological or the architectural sides of the profession and are less variable; so their characteristics are well known. Lamps may be roughly divided into open flame lamps (torches, oil lamps, open gas flames); flame heated incandescent lamps (mantle gas and oil lamps); electrically heated incandescent lamps (carbon and tungsten electric lamps); and electric arcs (carbon arcs, metallic arcs, flame arcs). Of these the electric arcs are the most efficient; though the best of them have an efficiency of only about 15%, which is about 2.5 times that of the tungsten incandescent lamp and 150 times that of the mantle gas lamp.

While illuminating engineering has been done in the past and is

being done at present by architects and engineers who do not specialize along this line; yet even the above brief discussion shows that the solution of the larger problems requires knowledge and skill beyond those possessed by the average architect and engineer; and therefore the profession of illuminating engineering has come into existance. The field of the illuminating engineer is the design of illuminating systems which will satisfy the user from both the utilitarian and æsthetic standpoints and at the same time be practical from the financial standpoint.

The rapid growth of the profession is shown by the membership of the Illuminating Engineering Society, which is only five years old, being 1530; of which 61% are engaged in supplying electrical eneregy, 21.3% in supplying illuminating gas, 5.4% in the making of fixtures and globes, 4.7% in teaching, .8% are architects and .3% are illuminating engineers, leaving an unclassified remainder of 6.5%. The members of the society have held 35 technical meetings during the past year.

The general interest in illuminating problems is shown by the fact that there is a monthly magazine, of no mean proportions, which is devoted exclusively to the field of illumination and both the gas and electrical engineering magazines devote considerable space to this field.